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Appl. No. 10/605,248
Amd. Dated July 27, 2004

IN THE SPECIFICATION:

Please paragraph [0017] with the following amended paragraph.

[0017] Another aspect of the invention relates to a method for generating a downlink signal comprising coupling an actuation device to a pump control panel, coupling the actuation device to a pump control device on the pump control panel, and creating a pulse in a drilling fluid flow by selectively controlling the pump control device with the actuation device.

Please replace paragraph [0076] with the following amended paragraph.

[0076] A typical prior art method of sending a downlink system involves interrupting drilling operations and manually operating the control knobs 504, 505, 506 to cause the mud pumps to cycle on and off. Alternatively, the control knobs 504, 505, 506 may be operated to modulate the pumping rate so that a downlink signal may be sent while drilling continues. In both of these situations, a human driller operates the control knobs 504, 505, 506. It is noted that, in the art, the term "driller" often refers to a particular person on a drilling rig. As used herein, the term "driller" is ~~user~~ used to refer to any person on the drilling rig.

Please replace paragraph [0079] with the following amended paragraph.

[0079] In some embodiments, the actuation devices 511, 513, 515 are integral to the control console 502. In some other embodiments, the actuation devices 511, 513, 515 may be attached to the control console 502 to operate the control knobs 504, 505, 506. For example, the actuation devices 511, 513, 515 may be magnetically coupled to the console 502. Other methods of coupling an actuation device to a console include screws and a latch mechanism. Those having skill in the art will be able to devise other methods for attaching an actuation ~~device~~ device to a console that do not depart from the scope of the invention.

Please replace paragraph [0086] with the following amended paragraph.

In some other embodiments, a downlink system comprises a device that causes the mud pumps to operate inefficiently or that causes at least a portion of the mud pumps to temporarily stop operating. For example, Figure 6 diagrammatically shows a pump inefficiency controller ~~601~~ 604 attached to a mud pump 602a. Figure 6 shows three mud pumps 602a, 602b, 602c.

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Drilling rigs can include more or fewer than three mud pumps. Three are shown in Figure 6A for illustrative purposes.

Please replace paragraph [0087] with the following amended paragraph.

Each of the mud pumps 602a, 602b, 602c draws mud from the mud storage tank ~~604~~ 601 and pumps the mud into the standpipe 608. Ideally, the mud pumps 602a, 602b, 602c will pump at a constant flow rate. The pump inefficiency controller ~~604~~ 604 is connected to the first mud pump 602a so that the controller ~~604~~ 604 may affect the efficiency of the first mud pump 602a.

Please replace paragraph [0089] with the following amended paragraph.

The first piston 621 includes a valve controller 628 that forms part of, or is operatively coupled to, the pump inefficiency controller (~~604~~ 604 in Figure 6A). When it is desired to send a downlink signal, the valve controller 628 prevents the intake valve 627 on the first piston 621 from opening during the intake stroke. As a result, the first piston 621 will not draw in any mud that could be pumped out during the exhaust stroke. By preventing the intake valve 627 from opening, the efficiency of the first pump 603 is reduced by about 33%. The efficiency of the entire pumping system (including all three mud pumps 602a, 602b, 602c in the embodiment shown in Figure 6A, for example) is reduced by about 11%.

Please replace paragraph [0090] with the following amended paragraph.

By operating the pump inefficiency controller (~~604~~ 604 in Figure 6A), the efficiency, and thus the flow rate, of the mud pumping system can be reduced. Intermittent or selective operation of the pump efficiency controller creates pulses in the mud flow rate that may be detected by sensors in the BHA.

Please replace paragraph [0091] with the following amended paragraph.

[0091] One or more embodiments of a pump inefficiency controller may present some of the following advantages. An inefficiency controller may be coupled to any preexisting mud pump system. The downlink system may operate without the need to add any equipment to the pump system. The pump inefficiency controlled may be controlled by a computer or other automated process ~~to~~ so that human error in the pulse generation is eliminated. Without human

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error, the downlink signal may be transmitted more quickly with a greater chance of the signal being received correctly on the first attempt.

Please replace paragraph [0095] with the following amended paragraph.

[0095] Selected operation of the downlink pump 711 will create a modulation of the mud flow rate to the BHA (not shown). The modulation will not only include a decrease in the flow rate—as with the bypass systems described above—but it will also include an increase in the flow rate that is created on the exhaust stroke of the downlink pump 711. The frequency of the downlink signal may be controlled by varying the ~~speed~~ speed of the downlink pump 711. The amplitude of the downlink signal may be controlled by changing the stroke length or piston and sleeve diameter of the downlink pump 711.

Please replace paragraph [0098] with the following amended paragraph.

[0098] The downlink system includes two diaphragm pumps 821, 825 whose intakes and discharges are connected to the mud manifold 807. The ~~first~~ diaphragm pumps 821, 825 ~~includes a diaphragm~~ include diaphragms 822, 826 that ~~separates~~ separate the pumps 821, 825 into two sections. The position of the diaphragm 822 may be pneumatically controlled with air pressure on the back side of the diaphragm 822. In some embodiments, the position of the diaphragm 822 may be controlled with a hydraulic actuator mechanically linked to diaphragm 822 or with an electromechanical actuator mechanically linked to diaphragm 822. When the air pressure is allowed to drop below the pressure in the mud manifold 807, mud will flow from the manifold 807 into the diaphragm pump 821. Conversely, when the pressure behind the diaphragm 822 is increased above the pressure in the mud manifold 807, the diaphragm pump 821 will pump mud into the mud manifold 807.

Please replace paragraph [0100] with the following amended paragraph.

[0100] Figure 9 diagrammatically shows another embodiment of a downlink pump 911 in accordance with the invention. The discharge of the downlink pump 911 is connected to the mud manifold 907, and the intake of the downlink pump 911 is connected to the mud tank ~~704~~ 904. The downlink pump 911 in this embodiment pumps mud from the mud tank 904 into the

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mud manifold 907, thereby increasing the nominal flow rate produced by the mud pumps 902a, 902b, 902c.